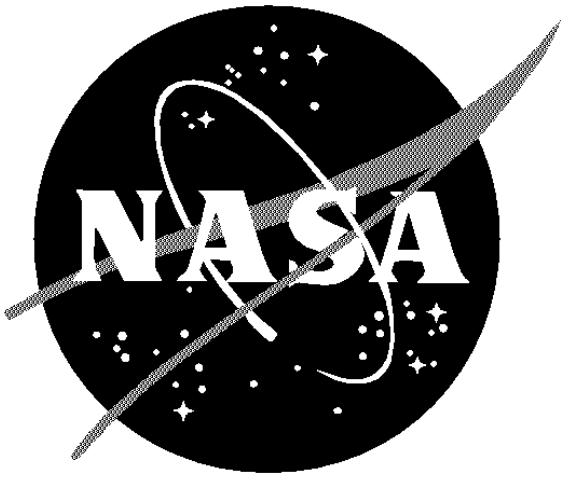

National Aeronautics and Space Administration

September 29, 1999

NRA-99-OES-05

RESEARCH ANNOUNCEMENT

US COMPONENT OF THE OZONE MONITORING INSTRUMENT (OMI) SCIENCE TEAM

Letters of Intent Due October 22, 1999 (4:30 PM EDT)

Proposals Due December 9, 1999 (4:30 PM EST)

OMB Approval No. 2700-0087

US COMPONENT OF THE OZONE MONITORING INSTRUMENT (OMI) SCIENCE TEAM

NASA Research Announcement
Soliciting Research Proposals
for
Period Ending
December 9, 1999

NRA 99-OES-05
Issued September 29, 1999

Office of Earth Science
National Aeronautics and Space Administration
Washington, DC 20546

RESEARCH ANNOUNCEMENT FOR THE OZONE MONITORING INSTRUMENT (OMI) SCIENCE TEAM

This NASA Research Announcement (NRA) solicits research proposals for science investigations, the principal investigators of which will comprise the US science team members to be associated with the Ozone Monitoring Instrument (OMI), which is to be flown aboard NASA's Earth Observing System (EOS) Chemistry (CHEM) platform. Launch of CHEM is currently scheduled for late 2002. Proposals may be submitted under this NRA for research investigations that correspond to two levels of activity on the US science team for OMI: US Team Leader (TL) or Team Member (TM).

The OMI instrument will be provided to NASA at no cost for flight aboard EOS CHEM by the government of The Netherlands through the Netherlands Agency for Aerospace Programs (NIVR). Coordinated data processing, analysis, and validation efforts will be carried out by scientists from The Netherlands, Finland and the US, with potential participation by scientists from other countries. Overall science direction for OMI will be provided by the OMI Principal Investigator (PI), who is associated with the Royal Netherlands Meteorological Institute (KNMI). International coordination will be facilitated by a three-member OMI Science Advisory Board consisting of the OMI PI, a co-PI from the Finnish Meteorological Institute (FMI), and the US Project Scientist for OMI. The US Team Leader selected in response to this NRA will coordinate the activities carried out by the US members of the OMI Science Team with the OMI PI and the OMI Science Advisory Board.

The investigators comprising the US component of the OMI team will be responsible for all OMI-related research carried out in the US, including instrument characterization, the development of algorithms, processing of data, and validation of data from OMI, as well as the development of combined data products using data from OMI and other sensors planned for flight aboard EOS CHEM. The US Team Leader selected in response to this announcement will lead the above activity. His/her major responsibility is to develop the US EOS standard data products with input from the Science Team members. He/she will ensure that the algorithms developed by the US Team Members are suitable for implementation, are coordinated and implemented in an optimal way, and that the data products are produced and archived consistent with appropriate guidelines of the EOS project. The responsibilities of the Team Leader and the Team members are further detailed in Appendix B.

The main US scientific aim for the OMI instrument aboard EOS CHEM is to continue and improve the data record of global total ozone measurements made with the Total Ozone Mapping Spectrometer (TOMS) series of instruments. This series consists of the Nimbus 7 TOMS (data available from

1978 to 1993), the Meteor-3 TOMS (data available from 1991 to 1994), the ADEOS TOMS (data available from 1996 to 1997), and the Earth Probe TOMS (data available from 1996 to the present) instruments. Other data products produced routinely by TOMS for which continuation by OMI will be a priority are the TOMS aerosol index and TOMS surface UV product.

OMI will provide spectral and spatial resolution that go significantly beyond those of the TOMS instruments, which will allow for additional data products (not produced from TOMS). Alternative methods for producing data products for the same quantities as studied by TOMS will be achievable with OMI. The many-wavelength technique used by OMI builds on that to be used by the Scanning Imaging Absorption Spectrometer for Atmospheric Cartography (SCIAMACHY) instrument aboard the European Space Agency's (ESA's) ENVISAT and its predecessor, the Global Ozone Monitoring Experiment (GOME) instrument flying aboard ESA's ERS-2 satellite since 1995. The characteristics of OMI are described in some detail in Appendix A.

The principal investigators selected response to this NRA will work on both types of quantities. The continuation of the existing TOMS records will require use of a comparable algorithm to that used for the current TOMS products using only a small number of discrete wavelengths. . The team leader will be responsible for developing, with the Team Members, and producing the standard data products (which include total ozone, aerosol index, and surface UVB radiation) and the requisite Algorithm Theoretical Basis Documents (ATBDs). This will be done in conjunction with the OMI Science Advisory Board. The algorithms and associated ATBDs for production of level 1b data from level 0 will be supplied by NIVR. Algorithms for additional data products or enhanced versions of existing data products that take fuller use of the capabilities of OMI will be prepared by the Team Members and coordinated through the US Team Leader and the OMI Science Advisory Board. Validation of data products will be the responsibility of the respective Team Members, although Team Members may propose specifically to focus on validation.

Team Members will be expected to provide copies of algorithms developed for additional or enhanced OMI data products to the US Team Leader so that they can be coordinated with existing algorithms. Data processing for standard products will be coordinated by the US Team Leader and funded through a separate data processing budget. All OMI standard data products will be archived in the Earth Observing System Data and Information System (EOSDIS) Distributed Active Archive Center (DAAC) at NASA's Goddard Space Flight Center. Proposers should include plans for processing and archival of any non-standard data products that they would produce.

Funding for the principal investigators who will serve as US members of the OMI Science Team is expected to ramp up to a maximum of approximately

$2.5 Million per year. Funding will begin in FY00.. Investigations selected under the OMI NRA are expected to continue till approximately one year after the beginning of operations of the EOS CHEM spacecraft (given the planned launch date for CHEM, the one year mark is estimated to occur in the early-mid part of Fiscal Year 2004). Thus, proposals can cover a period of a total of 4.5 years (assume FY00 funding covers the period 3/1/00-12/31/00, full calendar year funding in FY01-FY03, and FY04 funding covering the period 1/1/04-8/31/04). A planned review of all selected tasks will be carried out in 2002; those tasks not meeting minimum requirements for satisfactory progress will not be continued. New proposals may at that time be solicited to be implemented prior to the launch of EOS CHEM. It is anticipated the Team Member investigations would have annual funding levels in the vicinity of $100,000 to $150,000. Team Leader proposals may include requests for greater resources as are needed to meet all the requirements for the Team Leader as described in Appendix B. Detailed areas of scientific investigations for which Team Member proposals are desired are included in Appendix B. No a priori commitment is made towards the funding of proposals in each category indicated, however.

Because of the nature of the OMI Science Team, proposals are desired only for algorithm development, subsequent code development, first order validation of OMI data products, and development of synergistic science products making use of data from OMI together with those from other EOS CHEM instruments. **No field measurements will be provided under OMI Science Team funding.** Any validation efforts proposed under OMI Science Team funding must make use of existing, routinely operated measurement infrastructure, for which operation costs may only be requested as part of the OMI Science Team proposal when they are specifically incurred during the conduct of OMI-related scientific activities. **Laboratory measurements may only be proposed under OMI Science Team funding if it can be clearly demonstrated that those measurements are critical to the development of improved algorithms for OMI science data products.**

Some time closer to and after the launch of OMI, two EOS CHEM-related research announcements will be released - one for focused calibration/validation activities for CHEM instruments (including OMI) and one for use of CHEM data in science data analysis and interpretation (analogous to the "Guest Investigator Program" announcements issued for other NASA flight projects). **Proposals for focused validation studies of OMI data (e.g. through additional field measurements) or use of OMI data for scientific studies should be held until the release of these subsequent NRAs.**

Proposals may be submitted at any time during the period ending December 9, 1999, but not later than 4:30 PM EST on December 9, 1999. Proposals received after that date will be handled in accordance with NASA policy concerning late proposals (NFS 1815.208). Proposals will be peer reviewed by

approximately February 1, 2000. If accepted, they will be integrated into the FY00 research program beginning approximately March 1, 2000.

Participation in the US component of the OMI Science Team is open to all categories of organizations: educational institutions, industry, non-profit institutions, NASA centers, other US Government agencies, and international educational institutions, industries, and government agencies. Although entities from outside the US may propose for membership in the US component of the OMI Science Team, no funding will be provided to non-US institutions.

Funds are not presently available for awards under this NRA. The Government's obligation to make awards is contingent upon the availability of appropriated funds from which payment for award purposes can be made and the receipt of proposals which the Government determines are acceptable for award under this NRA.

Appendix A provides additional information on the technical details for the OMI instrument as they are currently known, as well as information on the other instruments flying aboard EOS CHEM (given the interest in combined data products). Specific instructions for proposers to this NRA are given in Appendix B. Appendix C contains the basic guidance needed for preparation of proposals in response to an NRA. Appendix D provides guidance for foreign participation. Appendix E includes required certifications and proposal cover sheet, which must be completed and returned to NASA with any proposal submitted in response to this NRA. Appendix F contains the budget summary form.

All prospective proposers to this announcement are strongly encouraged to submit a letter of intent no later than 4:30 PM on Friday, October 22, 1999. This will allow us to organize our peer review staff to adequately support the proposal review process. This letter of intent is available electronically via the Internet at URL http://www.earth.nasa.gov/loi. It is requested that these electronic letter of intent forms be used by all prospective proposers, although those lacking access to the Internet may submit a letter by fax to (202) 554-3024 with the following information:

- Proposing Team Leader's or Team Member's names and addresses (including Zip + 4)
- Title of proposal
- Contact information (phone and fax numbers and electronic mail address) for proposers
- A brief summary of the proposed research (Please limit this to no more than 3000 characters)

Identifier: NRA 99-OES-05

Submit Letters of Intent and Proposals to:

OMI NRA
Code Y
400 Virginia Avenue SW, Suite 700
Washington, DC 20024

For overnight mail delivery purposes only the recipient telephone number is (202) 554-2775.

Copies Required: 10

Selecting Official: Associate Administrator, Office of Earth Science

Obtain Additional Information From:
Dr. Jack A. Kaye
OMI Program Scientist
NASA Headquarters, Code YS
Washington, DC 20546
Tel.: (202) 358-0757
Fax: (202) 358-2770
e-mail: Jack.Kaye@hq.nasa.gov

Potential proposers with detailed questions about the OMI instrument or the other instruments about the EOS CHEM spacecraft should contact

Mr. Ernest Hilsenrath
EOS CHEM Deputy Project Scientist/
US Project Scientist for OMI
NASA Goddard Space Flight Center
Mail Code 916
Greenbelt, MD 20771
Tel.: (301) 614-6033
Fax: (301) 614-5903
e-mail: Ernest.Hilsenrath.1@gsfc.nasa.gov

or the OMI principal investigator

Dr. P. F. Levelt
KNMI
P. O. Box 201
3730AE DeBilt
THE NETHERLANDS
Tel: 011-31-30-220-6667
e-mail: levelt@knmi.nl

Your interest and cooperation in participating in this opportunity are appreciated.

Ghassem R. Asrar
Associate Administrator
Office of Earth Science

Enclosures:

Appendix A, “Technical Details on OMI and other EOS CHEM Instruments”

Appendix B, " Specific Guidelines for Proposers to this Announcement"

Appendix C, "Instructions for Responding to NASA Research Announcements"

Appendix D, "Guidelines for Foreign Proposals"

Appendix E, "Required Certifications and Cover Sheet"

Appendix F, "Budget Summary"

APPENDIX A:

TECHNICAL DETAILS ON OMI AND OTHER EOS CHEM INSTRUMENTS

OMI has a primary goal to carry on the long term mapping of total column ozone carried out by the Total Ozone Mapping Spectrometer (TOMS) series of instruments, but its spatial and spectral resolution will provide for a broad range of geophysically useful data products. The OMI multi-wavelength approach is similar in spirit to that used by the Global Ozone Monitoring Experiment (GOME) instrument that flies aboard the European Space Agency's ERS-2 satellite, launched in 1995. By flying as part of EOS CHEM, the possibility exists for simultaneous use of data from OMI and other EOS CHEM instruments to produce hybrid data products.

OMI will observe backscattered radiation from the Earth with a wide field telescope collecting ultraviolet and visible radiation for two imaging grating spectrometers. A "push-broom" technique will be used for the measurements. Two spectrometers are planned: one in the ultraviolet and one in the visible. Each spectrometer will employ a charge coupled device (CCD) detector (780 x 576 spectral x spatial pixels). The UV spectrometer will have two separate detector ranges. A summary of key information on the detectors is shown in the following table:

Channel	Total Range	Full Performance	Resolution	Pixels
UV-1	270 – 314 nm	270 – 310 nm	~ 0.64 nm	≥ 2
UV-2	306 - 380 nm	310 – 365 nm	0.45 nm	3
VIS	350 – 500 nm	365 – 500 nm	0.63 nm	3

The telescope field of view is 114 degrees, corresponding to 2600 km on the ground given the expected altitude of the EOS CHEM spacecraft. This coverage will allow for global coverage in 14 orbits (one day). Two seconds will be needed for each measurement. The ground size per pixel will be 3 km, which will be binned to 13 x 24 km for nominal viewing for the UV-2 channel; for the UV-1 channel the pixel size is 13x48 km in the global mode and the unbinned pixel size is twice as large as for UV-2. A 13 x 13 km mode will be available for occasional use for studies on detection and tracking of urban scale pollution sources. On-board calibration equipment will include a white light source, a light-emitting diode, and a multi-surface solar calibration diffuser. A depolarizer will remove polarization from backscattered radiation. The duty cycle for the instrument calls for continuous operation on the daytime side of the Earth. Average data rate will be 800 Kbps.

In addition to the standard TOMS data products (total column ozone, aerosol index, surface UV flux), it is expected that OMI can provide additional measurements, including:

• Total column amounts of trace constituents such as NO_2, SO_2, BrO, OClO, and HCHO

• Vertical profile of ozone

• Distinguish between aerosol types, such as smoke, dust, and sulfates

• Measure cloud top heights which provide data useful in determination of tropospheric ozone

Combined data products of OMI with other EOS CHEM instruments will be of great interest. For this reason, information on other planned EOS CHEM instruments is briefly summarized here (the reader is referred to the *1995 MTPE EOS Reference Handbook*, ed. Ghassem Asrar and Reynold Greenstone; available from EOS Project Science Office, Attn: Charlotte Griner, Code 900, NASA/GSFC, Greenbelt, MD 20771). Additional information may be obtained at the EOS CHEM website (http://eos-chem.gsfc.nasa.gov).

High Resolution Dynamics Limb Sounder (HIRDLS) is an infrared limb-scanning radiometer designed to measure concentrations of O_3, H_2O, CH_4, N_2O, NO_2, HNO_3, N_2O_5, $CFCl_3$, CF_2Cl_2, $ClONO_2$, aerosols, as well as the locations of polar stratospheric clouds (PSCs) and cloud tops. HIRDLS observations will be carried out with superior vertical and horizontal resolution to that previously obtained (expected 4° latitude x 4° longitude with 1 km vertical resolution). Altitude region for measurements will be from the upper troposphere to mesosphere, with altitude of measurement varying from species to species.

Microwave Limb Sounder (MLS) measures thermal emission from the atmospheric limb using millimeter and submillimeter wavelengths. Species to be observed include O_3, H_2O, ClO, HCl, OH, HNO_3, N_2O, SO_2, temperature, and pressure. The EOS CHEM MLS instrument will not only continue the measurements from the MLS instrument aboard the Upper Atmosphere Research Satellite but will provide significantly improved performance in the lower stratosphere and upper troposphere. MLS measurements can be made in the presence of ice clouds or aerosols.

Tropospheric Emission Spectrometer (TES) is a high spectral resolution imaging Fourier Transform Spectrometer which will be used to generate three-dimensional profiles of a broader range of infrared-active species from the Earth's surface to the lower stratosphere. Spectral resolution will be 0.025 cm^{-1} over the wavelength range from 2.3 to 14 μm. TES will have both a

nadir- and limb-viewing modes. Key observational targets unique to TES are the vertical distribution of ozone and several of its key precursors. Constituents for which TES will make measurements include O_3, CH_4, CO, N_2O, NO, NO_2, and HNO_3.

APPENDIX B:

SPECIFIC GUIDELINES FOR PROPOSERS TO THIS ANNOUNCEMENT

Proposals are solicited in two classes: US Team Leader (TL) and Team Member (TM).

US Team Leader proposals should emphasize the development of an algorithm by which standard OMI data products will be produced. These products should be consistent with those obtained from the Total Ozone Mapping Spectrometer (TOMS) instruments. The algorithm to be developed by the team leader should be similar in philosophy (e.g. using a very small number of discrete wavelengths) to the Version 7 algorithm used to produce TOMS data with possible enhancements using the hyperspectral capabilities of OMI. These data sets include total column ozone, TOMS aerosol index, and TOMS surface UV flux. The US Team Leader is expected to be able to demonstrate the accuracy of the algorithm through use of detailed radiative transfer modeling and simulations based on expected atmospheric composition and variability and expected performance characteristics of the OMI instrument. The US Team Leader will also need to assure that state-of-the-art input information on optical properties of relevant trace gases and atmospheric particles, as well as models of radiative transfer, are used in the algorithm. The US Team leader will have the primary responsibility for the development of the Algorithm Theoretical Basis Document (ATBD) required by the EOS project for the OMI standard data products.

US Team Leader proposals should include sufficient staffing to take retrieval approaches and specialized algorithms developed by Team Members, evaluate them to assure accuracy and consistency with assumptions and methods used in the algorithm used for development of standard products, and provide guidance to the Team Members as they either develop specialized computer programs for implementation of their individual algorithms or work with them to facilitate and/or initiate the development of coordinated algorithms for generation of the additional science data products. The Team Leader is also responsible for leading the US effort for recalibration and reprocessing of trend quality data sets for OMI products when needed. This effort will require extensive interaction with the OMI instrument scientists who will have detailed knowledge of the on-board performance characteristics of OMI. The Team Leader will be actively involved in the evaluation of OMI data through comparisons with relevant measurements made by other satellite measurement systems and routinely-operated ground networks. This will be a significant validation effort that will lead to the development of revised algorithms to further improve the accuracy of OMI data.

The US Team Leader will serve as point of contact with the EOS-Chem Project Scientist and the US OMI Project Scientist. He/She will also be a member of the OMI Science Coordinating Team which coordinates science activities among the US, Netherlands, and Finnish science teams. Responsibilities of this team include assuring compliance of instrument performance with respect to science objectives, establishing calibration and validation requirements, overall coordination of OMI science with the EOS-Chem mission, establishing publication protocols, and coordinating initial publications.

In preparing US Team Leader proposals, it should be assumed that costs of routine data processing (including any purchase of needed computer hardware and/or computer time) will be provided separately.

Team Member proposals may be provided in several areas. Note that validation through comparison with existing measurement networks may be included as part of proposals for each area, or may be lumped into a validation-oriented proposal. Team Member proposals may cover one or more of these different areas. Although proposals will be considered in all areas, no commitment is made to support proposals in each area. Proposals should clearly state which area(s) are included.

• Ozone - Alternative approaches for obtaining total column ozone amounts, as well as approaches for determining the vertical profile of stratospheric ozone using OMI data may be proposed. Such approaches may take fuller advantage of the spectral range and resolution provided by OMI than will be used by the standard processing approach implemented by the US Team Leader. Implementation of alternative algorithms will be carried out in conjunction with the OMI Science Advisory Board.

• Tropospheric Ozone - Approaches may be proposed for determination of tropospheric ozone distributions using OMI, either together with other data sets (especially those from other EOS CHEM instruments as described in Appendix A) through the Tropospheric Ozone Residual (TOR) method, or independently based on assumptions about stratospheric ozone variations, differences between clear vs. cloudy regions, differences between nearby low-lying or high altitude regions, etc.

• Tropospheric Aerosols - Support may be provided for development of enhanced OMI aerosol products, especially those using techniques taking advantage of the broader spatial and spectral coverage available from OMI relative to the standard product to be provided by the US Team Leader. Remote sensing methods that can shed light on the type of aerosol particle (e.g. sulfate, mineral desert dust, smoke from fires) are of particular interest.

• Sulfur Dioxide - Approaches may be proposed for obtaining distributions of atmospheric sulfur dioxide better. Of particular interest is the possibility of successfully retrieving sulfur dioxide distributions at lower levels than seen following large volcanic eruptions, such as in the vicinity of effusive volcanoes and large, polluted urban areas. Studies proposed may make synergistic use of data from OMI together with those from other EOS CHEM instruments.

• Surface UV and Visible Radiation - Support may be requested for development of enhanced data products for surface UV and visible radiation flux. These may be based on both the additional spectral resolution which OMI provides relative to TOMS as well as the significantly greater spectral range. Ways of using the higher spatial resolution may also be proposed.

• Additional Chemical Species - The spectral and spatial resolution of OMI should allow for retrieval of distributions (most likely column amounts) for several different atmospheric trace constituents, including NO_2, BrO, OClO, and HCHO. Algorithms for the retrieval of these constituents, which may involve use of data from other EOS CHEM instruments, may be proposed in response to this announcement.

• Cloud Data Products - The OMI data may provide information about a range of cloud products, including UV and visible reflectivity and, potentially, cloud top height. Proposals to use the full range of OMI data to obtain information about the distribution and optical properties of clouds in the atmosphere will be considered in this area.

• Land/Oceanic Products - The possibility exists that OMI, given its spatial and spectral resolution, may be able to provide scientifically useful products about some aspect of the land and/or ocean-covered parts of the Earth's surface. Proposals that seek to use OMI data for these purposes may be considered in this area.

• Applications - Studies in which OMI data can be made routinely available to the broader scientific, operational, and policy-making communities will be considered in this area. Examples include the use of OMI data for studies of tropospheric meteorology (including its use in forecasting procedures), hazard avoidance, and smoke/particle detection.

• OMI Algorithm Improvement - Proposals may be submitted in the general area of algorithm improvement whereby the techniques proposed would have the potential to enhance the quality and/or processing speed of the algorithms that would be used to generate either the standard data products (as carried out by the US Team Leader in conjunction with the OMI Science Advisory Board) or additional data products (as proposed by the individual Team Members).

• OMI Data Product Validation - Efforts emphasizing the validation of OMI data through comparison of OMI measurements with those from existing ground-, balloon-, and space-based networks may be proposed. Validation-focused proposals may be related to both the standard data products provided by the US Team Leader or the additional products likely to be proposed by the Team Members. **It is emphasized that this NRA will not provide support for gathering additional validation data; only data from routinely available measurement networks may be proposed here for OMI validation** (proposals to make additional measurements in support of OMI validation must await the release of the EOS CHEM calibration/validation NRA, which is expected to take place some 2 years before launch of EOS CHEM).

• OMI Instrument Characterization – Participation in the evaluation of instrument calibration and instrument performance with respect to planned OMI data products.

• Measurement of Fundamental Physical Properties of OMI Observables - Laboratory measurements of physical parameters (e.g. absorption cross sections) for OMI observables needed for retrieval of constituent distributions from OMI measurements may be proposed in response to this NRA. Proposals submitted for this section should very clearly state how the additional laboratory measurements will lead to improvements in accuracy and/or reduction in error bars for OMI measurements. This is the only section of this NRA to which laboratory measurements may be proposed.

Specific Instructions to Proposers

Although proposals from all interested members of the scientific community are desired, programmatic considerations and funding limitations place the following restrictions on proposals submitted in response to this NRA:

• The content of the proposal should provide sufficient detail to enable a reviewer to comprehend the nature of the proposed research and to assess its value, its relationship to the goals of the OMI Science Team, and the probability that the investigators will be able to accomplish the stated objectives within the requested resources.

• The evaluation criteria used for the Team Member proposals will be as described in Appendix C, section (i). For Team Leader proposals, a fourth criterion will be used: Capability of the Principal Investigator (PI) to successfully lead a complex scientific project involving algorithm development and integration, data processing, science product validation, publication of scientific results, and interaction with non-US partners. This

criterion will be weighted approximately equally with the three other criteria (relevance to NASA's objectives, intrinsic merit, and cost).

• **The technical part of the proposal should be limited to the equivalent of 15 single-spaced typewritten pages (including figures, tables, etc.), using type face which is a minimum of 12 point.** Additional pertinent information including publications, data, etc., may be added as attachments. Proposals should be self-contained. Reviewers, who will come from the three countries participating in OMI (US, The Netherlands, Finland), will be instructed that they are under no obligation to read anything beyond the 15 page limit (including attached preprints, etc.) or to examine any material in addition to the proposal (e.g. material available on proposers' web sites). Each proposal should contain the information indicated in Section (c) of Appendix C. Proposals should explicitly state on their cover sheets if the proposal is to be considered as a US Team Leader or Team Member proposal. Proposals should be submitted without any non-recyclable material (e.g. plastic binding, plastic covers).

• Respondents having support from other NASA/Office of Earth Science (OES) programs should include a list of such support and clear, concise statements of how their work proposed under this NRA complements and/or extends their current OES-funded work..

• Budgets should assume funding begins on January 1, 2000 and goes through the period August 31, 2004. Funding should be by calendar year for the first four years (2000-2003) with a final funding period of nine months covering the period from January 1, 2004 through August 31, 2004.. Proposers should recognize that a review will be held in approximately early 2002, and any proposals not meeting minimum standards for progress will not be continued beyond into subsequent funding periods.

• All US investigators should include in each year the cost of one three day program review in the vicinity of Washington, DC in their budgets, and one three-day joint science meeting with the Dutch, Finnish, and US investigators in the vicinity of Amsterdam, The Netherlands (for budgeting purposes, local costs for Amsterdam should be used).

• Vitae should be included for each principal investigator and co-investigator associated with the proposal. In order to keep the size of proposals to a reasonable level, **no more than three pages** (including a summary of education, relevant experience, honors, awards, community service activities, and a listing of the most relevant publications) should be included for each principal or co-investigator.

• Included with this NRA as Appendix E are (1) Form ED 80-0004 "Certification Regarding Drug-Free Workplace Requirements: Grantees Other

Than Individual," (2) Form ED GCS-008 (REV. 12/88), "Certification Regarding Debarment, Suspension, and other Responsibility Matters: Primary Covered Transactions," and (3) Form GCS-008 (REV. 12/88), "Certification Regarding Lobbying." Also included is a cover sheet, which should be completed and used with each proposal. One set of these completed forms must be included with the original signature version of all proposals.

Appendix C

INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH ANNOUNCEMENTS

(JANUARY 1997)

(a) General.

(1) Proposals received in response to a NASA Research Announcement (NRA) will be used only for evaluation purposes. NASA does not allow a proposal, the contents of which are not available without restriction from another source, or any unique ideas submitted in response to an NRA to be used as the basis of a solicitation or in negotiation with other organizations, nor is a pre-award synopsis published for individual proposals.

(2) A solicited proposal that results in a NASA award becomes part of the record of that transaction and may be available to the public on specific request; however, information or material that NASA and the awardee mutually agree to be of a privileged nature will be held in confidence to the extent permitted by law, including the Freedom of Information Act.

(3) NRAs contain programmatic information and certain requirements which apply only to proposals prepared in response to that particular announcement. These instructions contain the general proposal preparation information which applies to responses to all NRAs.

(4) A contract, grant, cooperative agreement, or other agreement may be used to accomplish an effort funded in response to an NRA. NASA will determine the appropriate instrument. Contracts resulting from NRAs are subject to the Federal Acquisition Regulation and the NASA FAR. Supplement. Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NPG 5800.1).

(5) NASA does not have mandatory forms or formats for responses to NRAs; however, it is requested that proposals conform to the guidelines in these instructions. NASA may accept proposals without discussion; hence, proposals should initially be as complete as possible and be submitted on the proposers' most favorable terms.

(6) To be considered for award, a submission must, at a minimum, present a specific project within the areas delineated by the NRA; contain sufficient technical and cost information to permit a meaningful evaluation; be signed by an official authorized to legally bind the submitting organization;

not merely offer to perform standard services or to just provide computer facilities or services; and not significantly duplicate a more specific current or pending NASA solicitation.

(b) NRA-Specific Items. Several proposal submission items appear in the NRA itself: the unique NRA identifier; when to submit proposals; where to send proposals; number of copies required; and sources for more information. Items included in these instructions may be supplemented by the NRA.

(c) The following information is needed to permit consideration in an objective manner. NRAs will generally specify topics for which additional information or greater detail is desirable. Each proposal copy shall contain all submitted material, including a copy of the transmittal letter if it contains substantive information.

(1) Transmittal Letter or Prefatory Material.

(i) The legal name and address of the organization and specific division or campus identification if part of a larger organization;

(ii) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press;

(iii) Type of organization: e.g., profit, nonprofit, educational, small business, minority,
women-owned, etc.;

(iv) Name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation;

(v) Identification of other organizations that are currently evaluating a proposal for the same efforts;

(vi) Identification of the NRA, by number and title, to which the proposal is responding;

(vii) Dollar amount requested, desired starting date, and duration of project;

(viii) Date of submission; and

(ix) Signature of a responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization (unless the signature appears on the proposal itself).

(2) **Restriction on Use and Disclosure of Proposal Information**. Information contained in proposals is used for evaluation purposes only. Offerors or quoters should, in order to maximize protection of trade secrets or other information that is confidential or privileged, place the following notice on the title page of the proposal and specify the information subject to the notice by inserting an appropriate identification in the notice. In any event, information contained in proposals will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice.

Notice

Restriction on Use and Disclosure of Proposal Information

The information (data) contained in [insert page numbers or other identification] of this proposal constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed other than for evaluation purposes; provided, however, that in the event a contract (or other agreement) is awarded on the basis of this proposal the Government shall have the right to use and disclose this information (data) to the extent provided in the contract (or other agreement). This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

(3) **Abstract.** Include a concise (200-300 word if not otherwise specified in the NRA) abstract describing the objective and the method of approach.

(4) **Project Description**.

(i) The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected significance; relation to the present state of knowledge; and relation to previous work done on the project and to related work in progress elsewhere. The statement should outline the plan of work, including the broad design of experiments to be undertaken and a description of experimental methods and procedures. The project description should address the evaluation factors in these instructions and any specific factors in the NRA. Any substantial collaboration with individuals not referred to in the budget or use of consultants should be described. Subcontracting significant portions of a research project is discouraged.

(ii) When it is expected that the effort will require more than one year, the proposal should cover the complete project to the extent that it can be

reasonably anticipated. Principal emphasis should be on the first year of work, and the description should distinguish clearly between the first year's work and work planned for subsequent years.

(5) **Management Approach**. For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities and arrangements for ensuring a coordinated effort should be described.

(6) **Personnel**. The principal investigator is responsible for supervision of the work and participates in the conduct of the research regardless of whether or not compensated under the award. A short biographical sketch of the principal investigator, a list of principal publications and any exceptional qualifications should be included. Omit social security number and other personal items which do not merit consideration in evaluation of the proposal. Give similar biographical information on other senior professional personnel who will be directly associated with the project. Give the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants, together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

(7) **Facilities and Equipment.**

(i) Describe available facilities and major items of equipment especially adapted or suited to the proposed project, and any additional major equipment that will be required. Identify any Government-owned facilities, industrial plant equipment, or special tooling that are proposed for use. Include evidence of its availability and the cognizant Government points of contact.

(ii) Before requesting a major item of capital equipment, the proposer should determine if sharing or loan of equipment already within the organization is a feasible alternative. Where such arrangements cannot be made, the proposal should so state. The need for items that typically can be used for research and non-research purposes should be explained.

(8) **Proposed Costs.**

(i) Proposals should contain cost and technical parts in one volume: do not use separate
"confidential" salary pages. As applicable, include separate cost estimates for salaries and wages; fringe benefits; equipment; expendable materials and supplies; services; domestic and foreign travel; ADP expenses; publication or page charges; consultants; subcontracts; other miscellaneous identifiable direct costs; and indirect costs. List salaries and wages in appropriate organizational categories (e.g., principal investigator, other scientific and engineering professionals, graduate students, research assistants, and technicians and other non-professional personnel). Estimate all staffing data in terms of staff-months or fractions of full-time.

(ii) Explanatory notes should accompany the cost proposal to provide identification and estimated cost of major capital equipment items to be acquired; purpose and estimated number and lengths of trips planned; basis for indirect cost computation (including date of most recent negotiation and cognizant agency); and clarification of other items in the cost proposal that are not self-evident. List estimated expenses as yearly requirements by major work phases.

(iii) Allowable costs are governed by FAR Part 31 and the NASA FAR Supplement Part 1831 (and OMB Circulars A-21 for educational institutions and A-122 for nonprofit organizations).

(9) **Security**. Proposals should not contain security classified material. If the research requires access to or may generate security classified information, the submitter will be required to comply with Government security regulations.

(10) **Current Support**. For other current projects being conducted by the principal investigator, provide title of project, sponsoring agency, and ending date.

(11) **Special Matters.**

(i) Include any required statements of environmental impact of the research, human subject or animal care provisions, conflict of interest, or on such other topics as may be required by the nature of the effort and current statutes, executive orders, or other current Government-wide guidelines.

(ii) Proposers should include a brief description of the organization, its facilities, and previous work experience in the field of the proposal.

Identify the cognizant Government audit agency, inspection agency, and administrative contracting officer, when applicable.

(d) **Renewal Proposals**

(1) Renewal proposals for existing awards will be considered in the same manner as proposals for new endeavors. A renewal proposal should not repeat all of the information that was in the original proposal. The renewal proposal should refer to its predecessor, update the parts that are no longer current, and indicate what elements of the research are expected to be covered during the period for which support is desired. A description of any significant findings since the most recent progress report should be included. The renewal proposal should treat, in reasonable detail, the plans for the next period, contain a cost estimate, and otherwise adhere to these instructions.

(2) NASA may renew an effort either through amendment of an existing contract or by a new award.

(e) **Length.** Unless otherwise specified in the NRA, effort should be made to keep proposals as brief as possible, concentrating on substantive material. Few proposals need exceed 15-20 pages. Necessary detailed information, such as reprints, should be included as attachments. A complete set of attachments is necessary for each copy of the proposal. As proposals are not returned, avoid use of "one-of-a-kind" attachments.

(f) **Joint Proposals**.

(1) Where multiple organizations are involved, the proposal may be submitted by only one of them. It should clearly describe the role to be played by the other organizations and indicate the legal and managerial arrangements contemplated. In other instances, simultaneous submission of related proposals from each organization might be appropriate, in which case parallel awards would be made.

(2) Where a project of a cooperative nature with NASA is contemplated, describe the contributions expected from any participating NASA investigator and agency facilities or equipment which may be required. The proposal must be confined only to that which the proposing organization can commit itself. "Joint" proposals which specify the internal arrangements NASA will actually make are not acceptable as a means of establishing an agency commitment.

(g) **Late Proposals**. A proposal or modification received after the date or dates specified in an NRA may be considered if doing so is in the best interests of the Government.

(h) **Withdrawal.** Proposals may be withdrawn by the proposer at any time before award. Offerors are requested to notify NASA if the proposal is funded by another organization or of other changed circumstances which dictate termination of evaluation.

(i) **Evaluation Factors**

(1) Unless otherwise specified in the NRA, the principal elements (of approximately equal weight) considered in evaluating a proposal are its relevance to NASA's objectives, intrinsic merit, and cost.

(2) Evaluation of a proposal's relevance to NASA's objectives includes the consideration of the potential contribution of the effort to NASA's mission.

(3) Evaluation of its intrinsic merit includes the consideration of the following factors of equal importance:

(i) Overall scientific or technical merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.

(ii) Offeror's capabilities, related experience, facilities, techniques, or unique combinations of these which are integral factors for achieving the proposal objectives.

(iii) The qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel critical in achieving the proposal objectives.

(iv) Overall standing among similar proposals and/or evaluation against the state-of-the-art.

(4) Evaluation of the cost of a proposed effort may include the realism and reasonableness of the proposed cost and available funds.

(j) **Evaluation Techniques**. Selection decisions will be made following peer and/or scientific review of the proposals. Several evaluation techniques are regularly used within NASA. In all cases proposals are subject to scientific review by discipline specialists in the area of the proposal. Some proposals are reviewed entirely in-house, others are evaluated by a combination of in-house and selected external reviewers, while yet others are subject to the full external peer review technique (with due regard for conflict-of-interest and protection of proposal information), such as by mail or through assembled panels. The final decisions are made by a NASA

selecting official. A proposal which is scientifically and programmatically meritorious, but not selected for award during its initial review, may be included in subsequent reviews unless the proposer requests otherwise.

(k) **Selection for Award**.

(1) When a proposal is not selected for award, the proposer will be notified. NASA will explain generally why the proposal was not selected. Proposers desiring additional information may contact the selecting official who will arrange a debriefing.

(2) When a proposal is selected for award, negotiation and award will be handled by the procurement office in the funding installation. The proposal is used as the basis for negotiation. The contracting officer may request certain business data and may forward a model award instrument and other information pertinent to negotiation.

(l) **Cancellation of NRA**. NASA reserves the right to make no awards under this NRA and to cancel this NRA. NASA assumes no liability for canceling the NRA or for anyone's failure to receive actual notice of cancellation.

APPENDIX D

NRA SOLICITATION PROVISION

FOREIGN PROPOSALS AND PROPOSALS INCLUDING FOREIGN PARTICIPATION IN RESPONSE TO NASA RESEARCH ANNOUNCEMENTS

(a) NASA welcomes proposals from outside the U.S. However, investigators working outside the U.S. are not eligible for funding from NASA. Proposals from non-U.S. entities should not include a cost plan. Proposals from outside the U.S. and U.S. proposals that include non-U.S. participation must be endorsed by the respective government agency or funding/sponsoring institution in that country from which the non-U.S. participant is proposing. Such endorsement should indicate that the proposal merits careful consideration by NASA, and if the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.

(b) Successful and unsuccessful proposers will be contacted directly by the NASA sponsoring office. Copies of these letters will be sent to the sponsoring government agency. Should a non-U.S. proposal or a U.S. proposal with non-U.S. participation be selected, NASA's Office of External Relations, Earth Science Division, will arrange with the non-U.S. sponsoring agency for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsoring agency will each bear the cost of discharging their respective responsibilities. Depending on the nature and extent of the proposed cooperation, these arrangements may entail:

1. A letter of notification by NASA, and
2. An exchange of letters between NASA and the sponsoring governmental agency; or
3. A formal Agency-to-Agency Memorandum of Understanding (MOU).

(c) As stated in Paragraph b. above, foreign proposals accepted under this NRA will be implemented on the customary no-exchange-of-funds basis in which NASA and the sponsoring foreign agency will each bear the cost of discharging their respective responsibilities. Additionally, NASA funding may not be used to purchase a launch service from a non-U.S. source. However, the direct purchase of goods and/or services from non-U.S. sources by U.S. Principal Investigators or U.S. Co-Investigators is permitted. Proposers are advised that international purchases must meet NASA and Federal regulations and that these regulations may place an additional burden on the successful proposer that should be explicitly included in discussions of the proposed budget.

Proposals, along with the requested number of copies and Letter of Endorsement must be forwarded to NASA at the address specified in the main body of this NRA in time to arrive before the deadline established for this NRA. In addition, one copy of each of these documents should be sent to:

NASA Headquarters
Office of External Relations
Earth Science Division, Code IY
Washington, DC 20546
USA

Any materials sent by courier or express mail should include the street address 300 E Street, S. W., and substitute 20024-3210 for the indicated ZIP code.

Copies of letters of intent and proposals submitted from non-US institutions should also be submitted to the Netherlands Agency for Aerospace Programs (NIVR) at the following address:

NIVR
P. O. Box 35
2600AA Delft
THE NETHERLANDS

All proposals must be typewritten in English. All non-U.S. proposals will undergo the same evaluation and selection process as those originating in the U.S. Non-U.S. proposals and U. S. Proposals that include non-U.S. participation, must follow all other guidelines and requirements described in this NRA. Sponsoring non-U.S. agencies may, in exceptional situations, forward a proposal without endorsement to the above address, if review and endorsement are not possible before the announced closing date. In such cases, however, NASA's Earth Science Division of the Office of External Relations should be advised when a decision on the endorsement is to be expected.

Appendix E

Proposal Cover Sheet
NASA Research Announcement 99-OES-05
(US Component of OMI Science Team)

Proposal No. _____ (Leave Blank for NASA Use)

Title: _____

Principal Investigator::_____

Department:_____

Institution: _____

Street/PO Box: _____

City: _____ State: _____ Zip: _____

Country: _____ E-mail: _____

Telephone: _____ Fax: _____

Co-Investigators:

Name	Institution & Email Address	Address & Telephone
_____	_____	_____
_____	_____	_____
_____	_____	_____

Budget:
FY00: _____ FY01: _____ FY02: _____
FY03: _____ FY04: _____

Certification of Compliance with Applicable Executive Orders and U.S. Code

By submitting the proposal identified in this *Cover Sheet/Proposal Summary* in response to this Research Announcement, the Authorizing Official of the proposing institution (or the individual proposer if there is no proposing institution) as identified below:

- certifies that the statements made in this proposal are true and complete to the best of his/her knowledge;
- agrees to accept the obligations to comply with NASA award terms and conditions if an award is made as a result of this proposal; and
- confirms compliance with all provisions, rules, and stipulations set forth in the two Certifications contained in this NRA [namely, (i*) Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs, and (ii) Certifications, Disclosures, And Assurances Regarding Lobbying and Debarment & Suspension*].

Willful provision of false information in this proposal and/or its supporting documents, or in reports required under an ensuing award, is a criminal offense (U.S. Code, Title 18, Section 1001).

Title of Authorizing Institutional Official: _____

Signature: _____ Date: _____

Name of Proposing Institution: _____

Telephone: _____ E-mail: _____ Facsimile: _____

Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs

The *(Institution, corporation, firm, or other organization on whose behalf this assurance is signed, hereinafter called "Applicant ")* hereby agrees that it will comply with Title VI of the Civil Rights Act of 1964 (P.L. 88-352), Title IX of the Education Amendments of 1962 (20 U.S.C. 1680 et seq.), Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and the Age Discrimination Act of 1975 (42 U.S.C. 16101 et seq.), and all requirements imposed by or pursuant to the Regulation of the National Aeronautics and Space Administration (14 CFR Part 1250) (hereinafter called "NASA") issued pursuant to these laws, to the end that in accordance with these laws and regulations, no person in the United States shall, on the basis of race, color, national origin, sex, handicapped condition, or age be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the Applicant receives federal financial assistance from NASA; and hereby give assurance that it will immediately take any measure necessary to effectuate this agreement.

If any real property or structure thereon is provided or improved with the aid of federal financial assistance extended to the Applicant by NASA, this assurance shall obligate the Applicant, or in the case of any transfer of such property, any transferee, for the period during which the real property or structure is used for a purpose for which the federal financial assistance is extended or for another purpose involving the provision of similar services or benefits. If any personal property is so provided, this assurance shall obligate the Applicant for the period during which the federal financial assistance is extended to it by NASA.

this assurance is given in consideration of and for the purpose of obtaining any and all federal grants, loans, contracts, property, discounts, or other federal financial assistance extended after the date hereof to the Applicant by NASA, including installment payments after such date on account of applications for federal financial assistance which were approved before such date. The Applicant recognized and agrees that such federal financial assistance will be extended in reliance on the representations and agreements made in this assurance, and that the United States shall have the right to seek judicial enforcement of this assurance. This assurance is binding on the Applicant, its successors, transferees, and assignees, and the person or persons whose signatures appear below are authorized to sign on behalf of the Applicant.

NASA FORM 1206

CERTIFICATIONS, DISCLOSURES, AND ASSURANCES
REGARDING LOBBYING AND DEBARMENT & SUSPENSION

1. LOBBYING

As required by Section 1352, Title 31 of the U.S. Code, and implemented at 14 CFR Part 1271, as defined at 14 CFR Subparts 1271.110 and 1260.117, with each submission that initiates agency consideration of such applicant for award of a Federal contract, grant, or cooperative agreement exceeding $ 100,000, the applicant must **certify** that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit a Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

2. GOVERNMENTWIDE DEBARMENT AND SUSPENSION

As required by Executive Order 12549, and implemented at 14 CFR 1260.510, for prospective participants in primary covered transactions, as defined at 14 CFR Subparts 1265.510 and 1260.117—

(1) The prospective primary participant **certifies** to the best of its knowledge and belief, that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal department or agency.

(b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (l)(b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

(2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

APPENDIX F

BUDGET SUMMARY

For period from _____ to _____

- Provide a complete Budget Summary for year one and separate estimated for each subsequent year.
- Enter the proposed estimated costs in Column A (Columns B & C for NASA use only).
- Provide as attachments detailed computations of all estimates in each cost category with narratives as required to fully explain each proposed cost. See *Instructions For Budget Summary* on following page for details.

		NASA USE ONLY	
	A	**B**	**C**
1. Direct Labor (salaries, wages, and fringe benefits)	_____	_____	_____
2. Other Direct Costs:			
a. Subcontracts	_____	_____	_____
b. Consultants	_____	_____	_____
c. Equipment	_____	_____	_____
d. Supplies	_____	_____	_____
e. Travel	_____	_____	_____
f. Other	_____	_____	_____
3. Facilities and Administrative Costs	_____	_____	_____
4. Other Applicable Costs:	_____	_____	_____
5. SUBTOTAL--Estimated Costs	_____	_____	_____
6. Less Proposed Cost Sharing (if any)	_____	_____	_____
7. Carryover Funds (if any)			
a. Anticipated amount : _____			
b. Amount used to reduce budget	_____	_____	_____
8. Total Estimated Costs	_____	_____	XXXXXXX
9. APPROVED BUDGET	XXXXXX	XXXXXXX	_____

INSTRUCTIONS FOR BUDGET SUMMARY

1. Direct Labor (salaries, wages, and fringe benefits): Attachments should list the number and titles of personnel, amounts of time to be devoted to the grant, and rates of pay.

2. Other Direct Costs:
    a. Subcontracts: Attachments should describe the work to be subcontracted, estimated amount, recipient (if known), and the reason for subcontracting.
    b. Consultants: Identify consultants to be used, why they are necessary, the time they will spend on the project, and rates of pay (not to exceed the equivalent of the daily rate for Level IV of the Executive Schedule, exclusive of expenses and indirect costs).
    c. Equipment: List separately. Explain the need for items costing more than $5,000. Describe basis for estimated cost. General purpose equipment is not allowable as a direct cost unless specifically approved by the NASA Grant Officer. Any equipment purchase requested to be made as a direct charge under this award must include the equipment description, how it will be used in the conduct of the basic research proposed and why it cannot be purchased with indirect funds.
    d. Supplies: Provide general categories of needed supplies, the method of acquisition, and the estimated cost.
    e. Travel: Describe the purpose of the proposed travel in relation to the grant and provide the basis of estimate, including information on destination and number of travelers where known.
    f. Other: Enter the total of direct costs not covered by 2a through 2e. Attach an itemized list explaining the need for each item and the basis for the estimate.

3. Facilities and Administrative (F&A) Costs: Identify F&A cost rate(s) and base(s) as approved by the cognizant Federal agency, including the effective period of the rate. Provide the name, address, and telephone number of the Federal agency official having cognizance. If unapproved rates are used, explain why, and include the computational basis for the indirect expense pool and corresponding allocation base for each rate.

4. Other Applicable Costs: Enter total explaining the need for each item.

5. Subtotal-Estimated Costs: Enter the sum of items 1 through 4.

6. Less Proposed Cost Sharing (if any): Enter any amount proposed. If cost sharing is based on specific cost items, identify each item and amount in an attachment.

7. Carryover Funds (if any): Enter the dollar amount of any funds expected to be available for carryover from the prior budget period Identify how the funds will be used if they are not used to reduce the budget. NASA officials will decide whether to use all or part of the anticipated carryover to reduce the budget (not applicable to 2nd-year and subsequent-year budgets submitted for award of a multiple year award).

8. Total Estimated Costs: Enter the total after subtracting items 6 and 7b from item 5.